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The Quantum Butterfly Non-Effect

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Chaos theory says that a tiny, insignificant event or circumstance can have outsized influence in shaping the way a large, complex system evolves into the future. Many people are familiar with this so-called butterfly effect, an idea often traced to science fiction author Ray Bradbury's 1952 story "A Sound of Thunder." In that tale, a man who has time-traveled into the deep past to hunt a Tyrannosaurus rex inadvertently crushes a butterfly under his foot. When he returns to the present, he discovers that this seemingly trivial act altered the course of history—and not in a good way.

In the early 1970s, meteorologist and mathematician Edward Norton Lorenz articulated the butterfly effect in science and launched the field of chaos theory. In plain language, this version of the effect says that initial conditions strongly influence the evolution of highly complex systems. In Lorenz's metaphor, the flapping of a butterfly's wings in Brazil could ultimately lead a tornado in Texas that wouldn't have happened otherwise. By implication, if you could go back and alter the past even slightly, a different future would evolve within the system. The future containing your present would vanish.

The butterfly effect is well accepted in our everyday world, where classical physics describes systems above the atomic scale. But in the submicroscopic world where quantum mechanics reigns, different—and very strange—rules apply. Does the butterfly effect still hold true? If not, what happens instead?

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